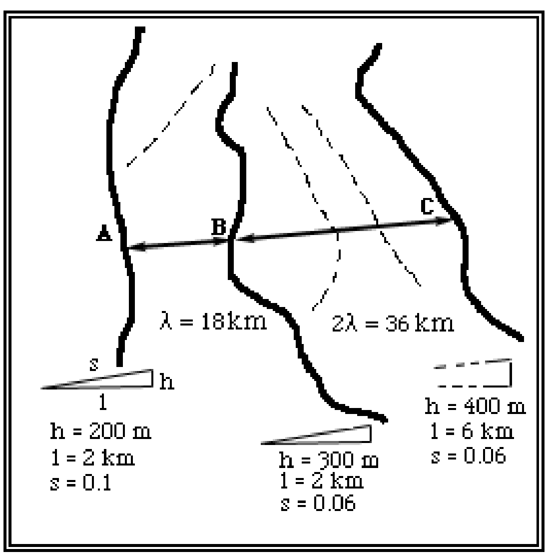
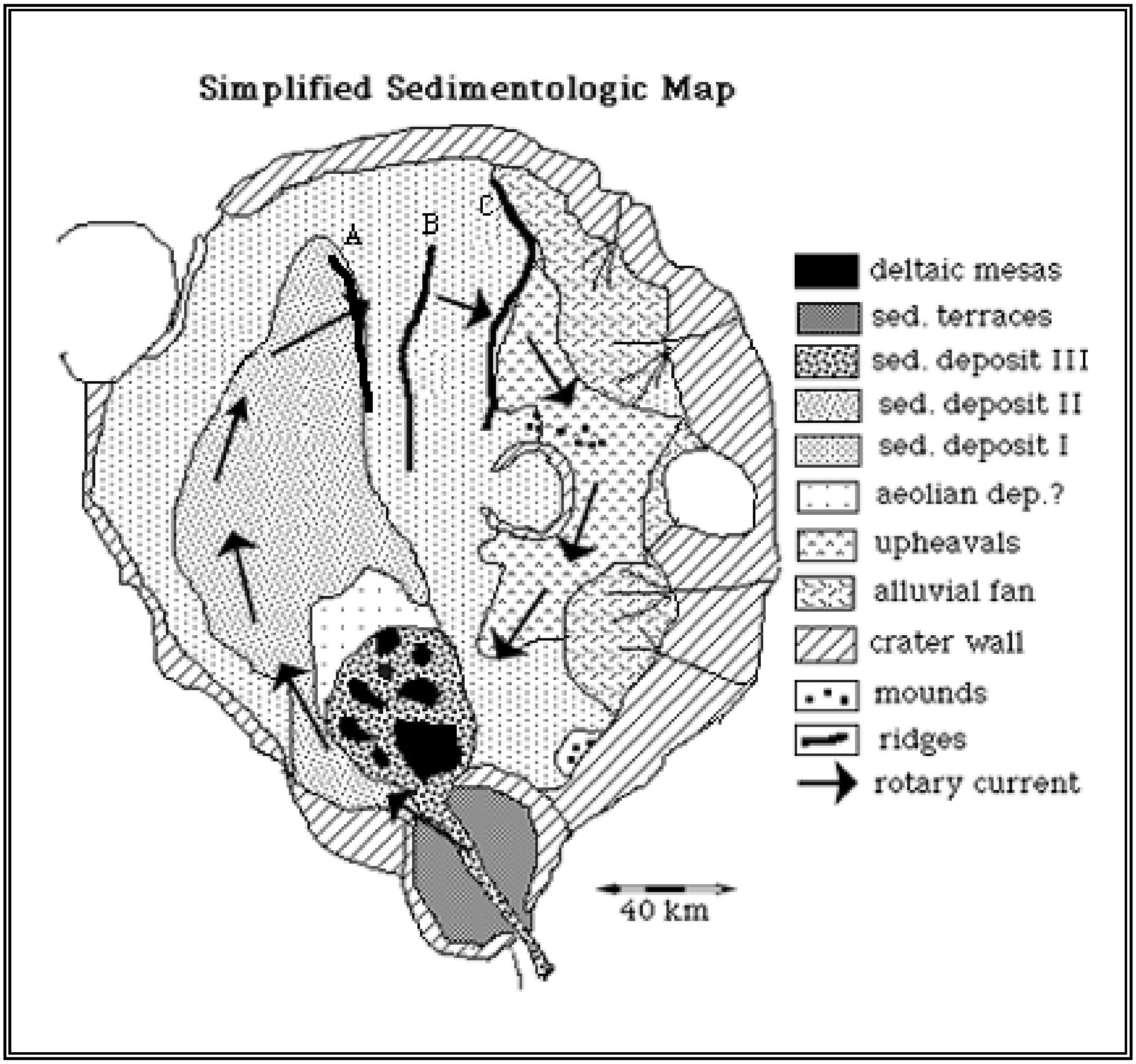
SUBGLACIAL ROTARY CURRENTS IN GUSEV CRATER PALEOLAKE (MARS),
E.A. GRIN AND N..A CABROL, NASA Ames Research Center, Space Science Division, MS 245-3, Moffett Field, CA 94035-1000.

Ridges that are generally attributed to volcanic activity may find a different origin in the case of Gusev crater, and be the result of rotary current in subice lake as suggested by terrestrial analogs.The characteristic sedimentary deposit morphologies observed on the paleolakebed of Gusev crater [1] compared to terrestrial Antarctic analogs suggest that they were generated by sublacustrine currents under an ice-covered lake. Antarctic lake analogs may predict the sediment morphologies that can be expected on the crater floor. Antarctic closed ice-covered lakes exhibit considerable water movement, producing horizontal and vertical currents [2]. Definite rotary movements by horizontal currents near the shoreline of the Antarctic ice-covered lake have been measured by radioactive tracers [3]. Another recent survey in Vostok Lake (central east Antarctica) reveals subice currents produced by the difference of pressure in the ice-cover and by the geothermal heat flux from the lakebed. Ice thickness measurements show that the ice-sheet is thicker in the center of the lake that at the border [4]. The result of this thickness variation is a lens-like shaped ice-cover that floats freely in hydrostatic equilibrium. The water/ice interface of the ice-cover is parallel to the lakebed. This configuration associated with the topography of the lake induces general circular water movements. In the case of Gusev crater, the tangent entrance of Ma'adim Vallis flows enhanced by the circular topography of the crater is likely to have generated a rotary subice current. Like in terrestrial analogs, this rotary current may have transported the fluvial sediment lakeward along the bottom of the crater lake. The monodirectional rotary-bed-movement organized bedforms accordingly to grain-size and current velocity. Larger-scale bedforms are located mainly on the lakeshore, where the velocity of the rotary current is higher than in the center. On Gusev crater floor, the depositional mechanism by subice current is illustrated by the marked asymmetrical distribution of the sediment in the axis of Ma'adim Vallis outlet that forms a 100 km-long eastward-incurvated tongue-shaped deposit (*see* sedimentologic map).This deposit is crossed by linear bedforms. These crossing structures are dune-like, flat-topped ridges, with steep foreset slopes ranging from 200 to 400 of meters high (*see* figure below). The steep foresets could correspond to the response to the monodirectional and perpendicular vortices force induced by the rotary currents [5]. A set of three major ridges is associated to smaller features of comparable orientation. Photoclinometric and morphologic survey allowed to define a geometric relationship between the high of the ridges and their wave length: the results gave: $h = 0.01\lambda$, where h is the maximum elevation of the ridge, and λ is the distance between two ridges (wave-length). The measures of the dune geometry gives a recurrent slope value of 0.06. This value (with the exception of ridge A) could be the indication that a material of comparable grain-size distribution was transported and deposited between ridges A and C. The wave-length between two ridges seems also to vary geometrically in the direction of the main slope in Gusev with a λ value of 18 km: $\delta AB = \lambda$; $\delta BC = 2\lambda$; $\delta AC = 3\lambda$; However, the number of ridges is not sufficient to define a general rule.



Conclusion: The model of rotary current analog in Gusev crater finds observational support with the presence of typical tongue-shaped sedimentary deposits, and organized ridge-systems. Further works will be to make an attempt to modelize the grain-size of the material that can be associated with these structures.

SUBGLACIAL ROTARY CURRENTS IN GUSEV CRATER, E.A. GRIN. AND N..A CABROL



Acknowledgment: This study was financially supported by the National Research Council grant for the second author.

References: [1] Cabrol N.A. *et al.* (1996) *Icarus* 123, 269-283; [2] Wetzel R. (1975) Limnology , Saunders ed.; [3] Ragotzie, R., and G. Likens (1975) *in* Limnology.; [4] Kapitsa, A.*et al.*, (1996), *Nature* 381, 684-686; [5] McLane, M. (1995) Sedimentology, Oxford Univ. Press ed.